IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Zhibo Zhao et al.	EXAMINER: Nguyen, Dinh Q.
SERIAL NO.:	10/646,551	GROUP ART UNIT: 3752
FILED:	August 21, 2003	ATTY DOCK. NO.: DP-308065
FOR:	COAXIAL LOW PRESSURE INJECTION METHOD AND A GAS COLLIMATOR FOR A KINETIC SPRAY NOZZLE	

REPLY BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Applicants submit the following Reply Brief in response to the Examiner's Answer dated February 9, 2007.

In short, the Examiner's Answer has added some comments regarding the requisite teaching, suggestion, or motivation needed for properly combining Van Steenkiste et al. (U.S. Patent No. 6,139,913) or Popoola et al. (U.S. Patent No. 6,464,933) and Roberts et al. (U.S. Patent No. 3,645,298) to arrive at the claimed invention. Applicants wish to address the Examiners new comments and summarize the reasons why the Examiner has failed to establish a *prima facie* case of obviousness for this combination. Claims 1-16 are currently on appeal. A claims appendix is attached for convenience.

Failure to Establish a *Prima Facie* Case of Obviousness

Claims 1-3 and 5-10 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Van Steenkiste et al. or Popoola et al. in view of Roberts et al. Applicants respectfully submit that the Examiner has not appropriately established the requisite *prima facie* case of obviousness.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some teaching, suggestion, or motivation, either in the references

themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references, when combined, must teach or suggest all the claim limitations. See MPEP 2143. The teaching, suggestion, or motivation to make the combination and the reasonable expectation of success must both be found in the prior art and not based on Applicants' disclosure. *All three of these criteria must be satisfied.*

Applicants respectfully assert that the Examiner has failed to satisfy the first criterion, i.e., establishing that there is some teaching, suggestion, or motivation to combine the references above, as required to establish a *prima facie* case of obviousness. Furthermore, Applicants assert that the Examiner has also failed to satisfy the third criterion, i.e., establishing that the combination of Van Steenkiste et al. or Popoola et al. with Roberts et al. teaches or suggests all the claim limitations. As indicated above, this third criterion is also required to establish the *prima facie* case of obviousness.

In one form or another, both independent claims 1 and 5 focus on a collimator having a central hole surrounded by a plurality of gas flow holes. The collimator has a length of from 10 to 30 millimeters with the gas flow holes having a hydraulic diameter of from 0.5 to 5.0 millimeters. The Examiner correctly recognizes that both Van Steenkiste et al. and Popoola et al. DO NOT disclose, teach, or otherwise suggest a collimator having a length of from 10 to 30 millimeters, nor do they teach or suggest gas flow holes having a hydraulic diameter of from 0.5 to 5.0 millimeters. Then, to supplement this deficiency associated with both Van Steenkiste et al. and Popoola et al., the Examiner relies, in error, on Roberts et al. Simply stated, there is no teaching, suggestion, or motivation to combine Van Steenkiste et al. or Popoola et al. and Roberts et al.

There is nothing disclosed or taught in Van Steenkiste et al. indicating that it is possible or even desirable to modify the length of its "flow straightener 40" and there is nothing disclosed or taught in Popoola et al. indicating that it is possible or even desirable to modify the length of its "diaphragm 26". There is no discussion, teaching, suggestion, or motivation in Van Steenkiste et al. for considering its flow straightener 40 let alone its

length to be a result effective variable on the deposition efficiency of the kinetic spray system as was discovered by the present inventors. Similarly, Popoola et al. is similarly silent as to any effect of its diaphragm 26 on the deposition efficiency of a kinetic spray system.

As for Roberts et al., this reference does not disclose, teach, or even suggest placing its collimated flow control device, or even its selected length, in a kinetic spray nozzle. Although the Examiner generally references column 1, lines 22+ of Roberts et al., the Examiner provides no convincing evidence why it is in the prior art to combine the collimator of Roberts et al. with a kinetic spray nozzle. Given that there is no discussion in Van Steenkiste et al. and in Popoola et al. of the gas collimators utilized and there is no discussion in Roberts et al. of kinetic spray systems, it is unclear how the Examiner can find that the present invention, which has been shown to provide a significant enhancement in the deposition efficiency of a kinetic spray system, would be obvious based on the references alone or in combination.

Granted, one must also consider knowledge of one having ordinary skill in the art when determining whether it is appropriate to combine the teachings of two different references. However, as discussed at length above, when doing so, i.e., when considering the knowledge of one having ordinary skill in the art, the teaching, suggestion, or motivation to make the claimed combination must both be found in the prior art, i.e., in the knowledge of those skilled in the art, and not based on Applicants' disclosure. Once again, obviousness may not be established by hindsight. *Kahn v. General Motors Corp.*, 45 USPQ2d 1608 (Fed. Cir. 1998). Determination of obviousness cannot be based on the hindsight combination of components selectively culled from the prior art to fit the parameters of the invention. *In re ATD Corp v. Lydal, Inc.*, 48 USPQ2d 1321, 1329 (Fed.Cir. 1998).

To rely on the combination of elements claimed in the subject application and then sift through the prior art looking for the elements claimed in the subject application is impermissible hindsight as discussed above and the Examiner cannot engage is such conduct. For the Examiner to reach a proper determination under 35 U.S.C. §103, the Examiner must follow the guidelines of MPEP 2142.

In the Examiner's Answer mailed February 9, 2007, the Examiner states on page 5 that "the Roberts reference also stated that the aspect ratio of a length to a cross section diameter can be selected to maintain the required pressure drop for gas passing through the collimator, it is well known in the art that the less pressure in a flow, the more uniform flow will be." While these comments may serve as part of the Examiner's reasoning as to why one having ordinary skill in the art would be motivated to combine Roberts et al. with Van Steenkiste et al. or Popoola et al., Applicants find the Examiner's comments to be misplaced. Applicants are not claiming an "aspect ratio", nor do the inventors even suggest that a certain aspect ratio provides the best results. Furthermore, the Applicants do not suggest that a desired "pressure drop" or "more uniform flow" contributes in some way to the unexpected results found by the inventors with respect to the increased deposition efficiency realized by the claimed collimator. Thus, these comments by the Examiner, even if found to be true cannot be said to provide the necessary teaching, suggestion, or motivation to add the collimator of Roberts et al. to the kinetic spray systems of Van Steenkiste et al. or Popoola et al.

One having ordinary skill in the art, not knowing what effects the collimator of Roberts et al. would have on deposition efficiency in a kinetic spray system, would not be motivated to make this combination to increase deposition efficiency. This is the realm of invention. Indeed, both Van Steenkiste et al. and Popoola et al. are completely silent as to the effect that changing the dimensions of its flow straightener or diaphragm would have on deposition efficiency. One having ordinary skill in the art, faced with the problem of increasing deposition efficiency, especially in low-pressure kinetic spray systems, may contemplate changing other parameters, but not the size of the collimator. This is where the inventors of the subject application applied their creative talents and provided the state of the art with a new and nonobvious manner in which deposition efficiency can be increased.

Importantly, Applicants are arguing that it is the claimed combination of the particular length of the collimator and the particular hydraulic diameter of the gas flow holes that is nonobvious and, therefore, patentable. In view of the above information outlining the claimed combination and also the Examiner's responsibilities relative to making combinations of prior art, it is apparent that there is no teaching, suggestion, or

motivation in the prior art to combine the references, as the Examiner is combining them.

Applicants further assert that the Examiner has failed to satisfy that the combination of Van Steenkiste et al. or Popoola et al. with Roberts et al. teaches or suggests all the claim limitations. It is established that neither Van Steenkiste et al. nor Popoola et al. disclose, teach, or suggest the diameter of the gas flow holes as particularly claimed. Relative to Roberts et al., the Examiner contends that this reference discloses a collimator having flow holes with a hydraulic diameter of 0.5 mm. This is not the case. In Roberts et al., every occurrence of the cross section dimension of its flow passages is under approximately 500 microns (which equals 0.5 mm). If Roberts et al. clearly indicates that this diameter is under 0.5 mm, Roberts et al. CANNOT possibly disclose the 0.5 to 5.0 mm as claimed in independent claims 1 and 5. The third criterion (teaching or suggestion of all claim limitations) is, therefore, not satisfied and the requisite *prima facie* case is not established.

Claim 4 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Van Steenkiste et al. or Popoola et al. or in view of Roberts et al. and further in view of Mochida et al. (U.S. Patent No. 4,740,408). The rejection to dependent claim 4 relies on the combination of Van Steenkiste et al. or Popoola et al. with Mochida et al. Applicants acknowledge the Examiner's withdrawal of the rejection of claims 1-3 and 5-10 based on Van Steenkiste et al. or Popoola et al. alone, without Roberts et al. Applicants believe this also changes the rejection to dependent claim 4 by requiring the combination of Van Steenkiste et al. or Popoola et al. and Roberts et al. As discussed above, this combination does not comport with the mandates of the MPEP for establishing a *prima facie* case of obviousness and is based on hindsight in view of Applicant's disclosure.

Claim 4 is dependent on claim 1 and adds that the gas flow holes have a hexagonal shape. As discussed above Van Steenkiste et al. or Popoola et al. taken in combination with Roberts et al. do not make independent claim 1 obvious. Claim 4 depends from independent claim 1. The Examiner further relies on Mochida et al. for disclosing gas flow holes having a hexagonal shape. The Examiner suggests that based on Mochida et al., changing the shape of the holes would provide an effective

gas flow device. Mochida et al. is directed toward a ceramic honeycomb body suitable for carrying catalizers to purify exhaust gas from internal combustion engines as disclosed in column 1, lines 1-10 of Mochida et al. It is not clear how the Examiner could find that one of ordinary skill in the art would be motivated to combine any of the shapes for the gas flow holes for the catalytic converters disclosed in Mochida et al. with the gas collimators disclosed in either Van Steenkiste et al. or Popoola et al. One having ordinary skill in the art would not look to catalytic converters to solve the problems regarding deposition efficiency in kinetic spray systems. The purpose and operational characteristics of these systems are completely different. Because dependent claim 4 includes limitations not found in nor made obvious based on the cited references, the rejection of claim 4 under 35 U.S.C. §103(a) based on the cited references is improper and should be withdrawn.

Claims 11-16 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Van Steenkiste et al. or Popoola et al. or in view of Roberts et al. and further in view of Belashchenko (U.S. Patent No. 5,932,293). The rejection to claims 11-16 relies on the combination of Van Steenkiste et al. or Popoola et al. with Belashchenko. This combination does not comport with the mandates of the MPEP for establishing a *prima facie* case of obviousness.

Dependent claim 11 adds that an injector tube extends through the throat of the nozzle into the diverging region of the nozzle. Dependent claims 12-16 depend from claim 11. Belashchencko et al. is directed toward a thermal spray system and not a kinetic spray system, as is the present invention. Applicants assume that the Examiner's reference in the Final Office Action to an injector tube 68 extending into a throat refers to Figure 7 of Belashchencko et al. A review of Figure 7 and the accompanying descriptive text of Belashchencko et al. reveal that there is no throat disclosed in the thermal spray system of Belashchencko et al. In addition, the injector 68a shown in Belashchencko et al. ends before the end of the converging section of the nozzle and does not extend through a throat as suggested by the Examiner and as required by dependent claim 11.

Even when combined with Van Steenkiste et al. or Popoola et al., Belashchencko provides no motivation for modifying the disclosures of Van Steenkiste

et al. or Popoola et al. to extend the powder injector tube through the throat of the supersonic nozzle and into the diverging section of the nozzle as required by claims 11-16. As disclosed in the present specification in paragraph [0033], the present inventors surprisingly found that extending the injector tube 50 in the low pressure nozzle system a distance beyond the end of the throat up to 1/3 of the length of the diverging section resulted in an increase in the deposition efficiency of the kinetic spray nozzle, which was unexpected. Such a result is not obvious given the disclosures of the cited references or the knowledge of one having ordinary skill in the art. In summary, dependent claim 11 includes limitations neither found in nor made obvious in view of the cited references taken alone or in combination, thus the rejection of dependent claim 11 and dependent claims 12-16, which depend from dependent claim 11, is improper and must be withdrawn.

The Examiner has failed to establish a *prima facie* case of obviousness by failing to disclose, teach, or suggest all of the claimed limitations or by failing to show a teaching, suggestion, or motivation to combine the references as suggested by the Examiner. Accordingly, the Board is respectfully requested to reverse the rejections of the claims as not fairly based upon the teachings of the references.

Respectfully submitted,

HOWARD & HOWARD ATTORNEYS, P.C.

April 9, 2007
Date

/Trent K. English/
Trent K. English, Registration No. 56,951
The Pinehurst Office Center, Suite 101
39400 Woodward Avenue
Bloomfield Hills, MI 48304-5151
(248) 723-0462

Claims Appendix

1. (Original) A gas collimator for a kinetic spray nozzle comprising:

a collimator having a central hole surrounded by a plurality of gas flow holes and a length of from 10 to 30 millimeters; said gas flow holes having a hydraulic diameter of from 0.5 to 5.0 millimeters.

2. (Original) The gas collimator as recited in claim 1 wherein the ratio of said hydraulic diameter to said length is from 1:5 to 1:50.

3. (Original) The gas collimator as recited in claim 1 wherein said length of said collimator is from 25 to 30 millimeters.

4. (Original) The gas collimator as recited in claim 1 wherein said gas flow holes have a hexagonal shape.

5. (Original) A kinetic spray nozzle comprising:

a supersonic nozzle having a gas collimator located between a premix chamber and a mixing chamber; said mixing chamber located adjacent to a converging section of said nozzle; a throat located between said converging section and a diverging section of said nozzle; said collimator having a central hole surrounded by a plurality of gas flow holes and a length of from 10 to 30 millimeters; said gas flow holes having a hydraulic diameter of from 0.5 to 5.0 millimeters.

6. (Original) The kinetic spray nozzle as recited in claim 5 wherein the ratio of said hydraulic diameter to said length is from 1:5 to 1:50.

7. (Original) The kinetic spray nozzle as recited in claim 5 wherein said length of said collimator is from 25 to 30 millimeters.

8. (Original) The kinetic spray nozzle as recited in claim 5 wherein said gas flow holes have one of a hexagonal shape or a circular shape.

9. (Original) The kinetic spray nozzle as recited in claim 5 wherein the ratio of a total open area of a cross-section of said collimator to a cross-sectional open area of said mixing chamber is from 0.5:1 to 0.9:1.

10. (Original) The kinetic spray nozzle as recited in claim 5 further including an injector tube received in said central hole and extending through said collimator.

11. (Original) The kinetic spray nozzle as recited in claim 10 wherein said injector tube extends through said throat into said diverging section of said nozzle.

12. (Original) The kinetic spray nozzle as recited in a claim 11 wherein said injector tube extends up to one third of a length of said diverging section past said throat.

13. (Original) The kinetic spray nozzle as recited in a claim 11 wherein said injector tube extends from 2 to 50 millimeters past said throat.

14. (Original) The kinetic spray nozzle as recited in a claim 11 wherein said injector tube extends from 5 to 30 millimeters past said throat.

15. (Original) The kinetic spray nozzle as recited in claim 11 wherein a gap between said injector tube and an inside of said throat permits an air flow of from 15 to 50 cubic feet per minute through said gap.

16. (Original) The kinetic spray nozzle as recited in claim 11 wherein a gap between said injector tube and an inside of said throat permits an air flow of from 25 to 35 cubic feet per minute through said gap.

17. (Withdrawn) A method of applying a material via a kinetic spray process comprising:

a) providing a particle powder;

b) providing a converging diverging supersonic nozzle having a gas collimator having a central hole surrounded by a plurality of gas flow holes and a length of from 10 to 30 millimeters; the gas flow holes having a hydraulic diameter of from 0.5 to 5.0 millimeters;

c) directing a flow of a gas through the collimator and the nozzle, the gas having a temperature insufficient to cause melting of the particles in the nozzle; and

d) entraining the particles in the flow of the gas and accelerating the particles to a velocity sufficient to cause the particles to adhere to a substrate positioned opposite the nozzle.

18. (Withdrawn) The method as recited in claim 17 wherein step b) further comprises providing a collimator where the ratio of the hydraulic diameter to the length is from 1:5 to 1:50.

19. (Withdrawn) The method as recited in claim 17 wherein step b) further comprises providing a collimator where the length of the collimator is from 25 to 30 millimeters.

20. (Withdrawn) The method as recited in claim 17 wherein step b) further comprises providing a collimator having one of a hexagonal or a circular shaped gas flow holes.